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SHORTER ARTICLES AND CORRESPONDENCE

EVOLUTION WITHOUT ISOLATION

Is isolation a factor of evolution? The answer must depend, obviously, on what we mean by evolution, as well as upon the relations of the facts. Every difference of opinion regarding the nature and causes of evolution involves the use of the word in a different sense, unless the process is to be renamed with each change of interpretation. The choice of words is worthy of careful consideration, but words should not lead us away from the broader issue of biological facts. The practical question is not whether the words or their senses are new or unusual, but whether the facts are correctly represented.

Being convinced that changes in the characters of species are spontaneous, I apply the word evolution to these spontaneous processes of change. This, of course, is not the meaning of those who believe that changes in species are brought about by external influences working upon normally stationary groups, who have been accustomed to think of evolution as a passive result of change in the environment, rather than as an active process, inherent in the species.

From one point of view evolution appears as a complex of different kinds of environmental influences, from the other as a process of growth in the species, somewhat analogous to the development of individual organisms of which species are composed. In the one case the species are thought of as being carried or pushed along by their environments, in the other as advancing by motions of their own, often in spite of environmental obstacles and deflections.

Belief in isolation as a factor of evolution marks an intermediate stage of opinion between those who hold that natural selection causes evolution, and those who reject selection as a cause. The effort is to maintain the doctrine of environmental causes by giving selection the assistance of other alleged factors, such as isolation, mutation, environmental variation, heredity, ontogeny, etc. Nevertheless, this course has its logical dangers for the theory of selection, for the placing of much emphasis on isolation is practically equivalent to saying that evolutionary

changes go on of themselves, without the need of environmental interference.

If we advance with sufficient confidence in isolation we eventually come through to the realization that our alleged environmental factors are unnecessary as causes, because evolution is spontaneous. This approximation of views has been recognized by Dr. John T. Gulick who states in the January number of the *AMERICAN NATURALIST* that our interpretations differ only in the meaning attached to the word evolution.¹

I am naturally very much pleased to agree with Dr. Gulick, for no other student of isolation has given the subject such extensive and thorough study. I subscribe to Dr. Gulick's statement that there does not seem to be any essential difference between us regarding facts. The difference is that the facts appear to me as of more significance than Dr. Gulick has represented. In attempting to point out this greater significance I have used a different method of expression.

To say that isolation and selection are factors of evolution should mean, in simpler English, that they cause evolution, or at least help it along, whereas they do neither. They appear to cause or to conduce to evolution only so long as we take it for granted that changes in the characters of species are dependent upon the subdivision of species, to form additional species.

The separation of a species into two or more parts allows the parts to become different, but there is every reason to believe that evolutionary changes of the same kind would take place if the species were not divided. That the isolated groups become different does not indicate that isolation assists in the process of change. It gives the contrary indication that changes are restricted by isolation. If isolation did not confine the new characters to the groups in which they arise, the groups would remain alike, instead of becoming different. Thus it appears to me that the danger of confusing the issues is much greater when we say that isolation and selection *are* factors of evolution, than when we say that they are *not* factors of evolution, however important they may be in multiplying and differentiating species.

Sufficiently narrow forms of isolation no doubt affect plants and animals in nature in the same way as the "intensive segre-

¹ Isolation and Selection in the Evolution of Species. The Need of Clear Definitions. *The American Naturalist*, 42: 48, January, 1908.

gation" by which domesticated types are induced to change some of their characters, but it does not appear that this intensive segregation is a condition of evolution. Differences between small groups are more obvious and more readily definable because small groups are generally more uniform, like the pieces with uniform patterns which may be cut from a variously figured fabric. Isolation is the shears that splits the species, not the loom that weaves it. The weaving is done when the fabric is broad. The larger and more diversified species make the truly constructive evolutionary progress.

The evolution of a species is in no way dependent upon its being split into smaller groups, but is more likely to be hindered by narrow subdivisions. If the groups are too small they degenerate and become extinct, instead of continuing their evolution. Isolation, though making more species, impedes evolution. In like manner, selection favors adaptation, because it keeps species from evolving in non-adaptive directions. Isolation and selection may still be considered as evolutionary factors if this time-honored reckoning is too sacred to be changed, but they must stand as negative factors instead of positive, if my interpretation is correct.

Darwin saw in his later years that evolution is not altogether the same as the formation of new species, and used in a letter (published after his death), the word "specification" as a means of expressing this distinction, a suggestion which I unwittingly repeated in proposing the slightly different word "speciation."²

There are two different classes of cases, as it appears to me, viz., those in which a species become slowly modified in the same country (of which I can not doubt there are innumerable instances) and those cases in which a species splits into two or three or more new species, and in the latter case, I should think nearly perfect separation would greatly aid in their "specification," to coin a new word.³

Darwin was concerned to show that species multiply and diverge in nature, for this is good evidence of the general fact of evolution. Nevertheless, it should not be assumed that all forms of divergence represent evolution, or that divergence is a true measure of evolution. Divergence may be less than evolution, for the evolutionary paths of related groups often follow

² Factors of Species-Formation, *Science*, N. S., 23: 506.

³ Life and Letters of Charles Darwin, 2: 339. New York, 1896.

nearly parallel directions. Divergence may be greater than evolution when changes are not progressive but sideways or backwards. Mutations, reversions, or degenerations, can take place suddenly, without the slow and gradual weaving of new characters in the network of descent of a species; they involve only the suppression of characters or the return to expression of old characters that continue to be transmitted in latent form.

As long as Dr. Gulick lets it appear that the divergencies of his snails arise through isolation, I fully agree with him, but not when he seems to suggest that isolation and selection produce new characters. The fact that isolated groups have no mutual sharing of evolutionary progress leaves them free to become more and more different, but the isolation does not explain the progressive changes to which the differences are due. Isolation explains *speciation*, but does not explain *evolution*.

This is the same objection that Darwin made to Wagner's theory of isolation, that it did not help him to understand "how or why it is that a long isolated form should almost always become slightly modified." Dr Gulick explains that his interpretation differs essentially from that of Wagner, who held that even natural selection must have an "isolated colony" to work upon. Nevertheless, it appears that Darwin's objection applies to Gulick's doctrine as well as to Wagner's, for isolation only reveals the fact of evolution, while a genuine "factor" should do something toward explaining it.

Such a factor Darwin believed that he had found in natural selection, but he saw in isolation alone nothing to aid evolution. Darwin took it for granted that species were *normally stationary* and most of his successors still accept this unevolutionary assumption. With Darwin evolution was a definite process by which the characters of a species are changed, but with some of our later writers it has become merely a general name for a subject of study, whose various phases or branches are loosely called "factors," though they have no apparent relation to the original concrete idea of evolution as a process of change in species.

The failure to give a more definite recognition and a name (evolution or otherwise) to the processes of spontaneous, progressive change in species, appears to me to have prevented the attainment of the complete clearness sought by Dr. Gulick in the presentation of his elaborate and valuable evidence that only

isolation is needed for evolutionary divergence to become manifest. If Dr. Gulick really agrees with me that evolution is spontaneous, I must submit that his adherence to the custom of treating isolation and selection as factors has served to conceal his conclusions, rather than to announce and defend them.

O. F. COOK.

WASHINGTON, July 16, 1908.

A NOTE ON THE SILVERSIDE

In view of its value as a food fish, and as food for other more valuable fishes,¹ the following note on the habits of the silverside has special interest.

At Chesapeake Beach, Md., April 19, 1908, p. m., the tide was rising and probably pretty well up. At points where weed and such riff raff was partially buried in the beach, in the wash of the ripples which followed one another in, numerous fishes were wiggling actively as though stranded. At times one would be almost or quite clear of the water, but so active were they that the writer, not having a net, was at first unable to capture any. They evidently knew what they were doing, as when a spot they occupied was approached, they disappeared from it. Finally, by striking quickly with a piece of wood at a place where some were congregated, three were disabled and secured, which proved, as anticipated, to be *Menidia menidia*.

Examination of a specimen of beach trash collected where the fishes were observed, at the time, shows the presence of a number of eggs, apparently of *Minidia*, strong evidence that the fish were spawning. These eggs are one mm. or a little more in diameter and bear filaments at one point which attach them to the beach material in which they occur more or less scattered. The white color of the egg (preserved in alcohol) is relieved by yellow oil masses. This spawning ground, if such it was, would certainly be exposed at low tide. The species, in this case its northern race, has previously been noted to spawn above low-tide level.² Chesapeake Bay is neutral ground between the northern and southern races of *Menidia menidia*, and the writer prefers to refer the specimens obtained to neither race.

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¹ W. C. Kendall. U. S. Fish Comm. Rept., 1901 (1902), p. 241.

² H. C. Bumpus, *Science*, N. S., Vol. VIII, No. 207, p. 851, Dec. 16, 1898.